SEMESTER EXAMINATION, DECEMBER, 2025

Course Name: - B. Tech. Semester:- III

Paper Name: - Discrete Mathematics Paper Code:- NCS-304

Time - 3 Hrs + 20 minutes per hour extra time for V.I. & examinees with writer. Max Marks-70

समय– 3 घण्टे + 20 मिनट प्रति घंटे अतिरिक्त–दृष्टिबाधित एवं सह लेखक परीक्षार्थियों के लिए। अधिकतम अंक–70

Instructions:

- The question paper consists of three sections namely A, B, C. All sections are compulsory.
- Section A- Each question carries **3 mark. All questions are compulsory**.
- Section B- Answer any **5 out of 7** given questions. Each question carries **7 marks**.
- Section C- Answer any **2 out of 3** given questions. Each question carries **10 marks**.

Section - A (खण्ड–अ)

Multiple Choice Questions (बहुविकल्पीय प्रश्न)

1. Answer all the following questions. 5x3 =15
निम्नलिखित सभी प्रश्न अनिवार्य हैं।

i) Power set of empty set has exactly _____ subset

(a) 1.

(b) 2

(c) 0

(d) NOTA

ii) The domain of the signum function is

(a) ∅

(b) {1,-1}

(c) {-1,0,1}

(d) {0, 1}

iii) The number of triangles of a polygon having n sides is

(a) $\binom{n}{2}$

(b) $\binom{n}{3}$

(c) $\binom{n}{2} - 1$

(d) NOTA

iv) A graph having 'e' edges has the number of vertices equals to

(a) 2e

(b) e/2

(c) 2e-1

(d) 3e

v) How many properties can be held by a group?

(a) 2

(b) 3

(c) 5

(d) 4

Section - B (खण्ड–ब)

Short Answer Questions (लघुउत्तरीय प्रश्न)

2. Answer any five of the following questions. 5x7=35

निम्नलिखित में से किन्हीं पाँच प्रश्नों के उत्तर दें।

i. Define countable and uncountable sets. Show that the set of integers is countable and set of real numbers is uncountable.

ii. Find the Domain and range of the function (a) $y = \sqrt{1-x}$ (b) $y = \frac{x}{1-x}$. Show that the function $f: R \to R$ defined as $f(x) = 3x + 4$ is one-one and onto.

iii. (a) Show that the 4, 4^{th} roots of unity form an abelian group with respect to the multiplication.

(b) Let H be a subset of a Group G the H is subgroup og Group G iff

$$a \in G, b \in G \Longrightarrow ab^{-1} \in G$$

iv. Let (G,.) and (G',.) be two groups and $f: G \to G'$ be an isomorphism then Show that
(a) f(e)=e' where e and e' are the identity elements of G and G'
(b) $f(a^{-1}) = \{f(a)\}^{-1}$
(c) If $a \in G$ then $f(a^n) = \{f(a)\}^n$

v. Discuss about Logic GATES and digital Circuits.

vi. Discuss about the trees and their types.

vii. Find the generating function for the sequence {2, 4, 10, 28,.....} and {1,2,3...}

Section - C

Descriptive Questions (विवरणात्मक प्रश्न)

3. Answer any two of the following question. 2x10=20

निम्नलिखित में से किन्हीं दो प्रश्नों के उत्तर दें।

i)

(a) Show the n, nth roots of unity form an abelian group with respect to multiplication.

(b) (i) How many three-digit numbers can be formed from the digits 0,1,2,3,4.

(ii) In how many ways 6 boys and 6 girls sit together in a row.

(iii) Find the number of triangles of a polygon having n sides.

(iv) Define subgroup and co-set.

ii)

(a) By using mathematical induction show that $1^3 + 2^3 + 3^3 + \cdots \ldots = \left\{\frac{n(n+1)}{2}\right\}^2$

(b) State and Prove Lagrange's theorem.

iii)

(a) Discuss about Lattices.

(b) Discuss about the Half adder and Full Adder.

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